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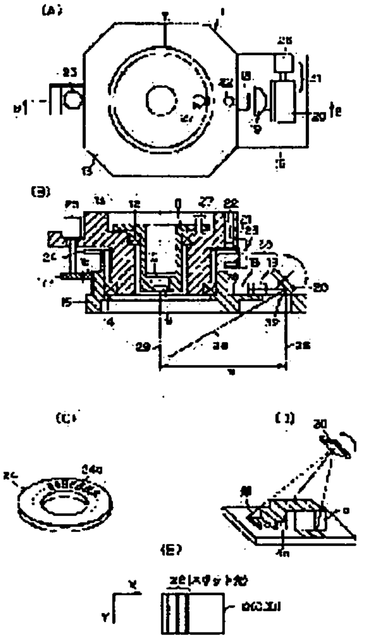
(54) PROJECTING-POINT MOVING TYPE RANGE FINDER

(57)Abstract:



PROBLEM TO BE SOLVED: To measure the range data of a work without shadow part with high accuracy in a short time.

SOLUTION: An image pickup holder 11 having the image pickup system of a lens 9 and a CCD 10 is supported by a fixing case 13 and a rotary stage 15 is supported by the fixing case 13 in such a way that they can be rotated about a central axis 29, respectively. A galvanmo-mirror 20 having a projecting point 32 is provided at the rotary stage 15, and the structuring light is scanned and projected on a work. The projected image reflected from the work is inputted into the CCD 10 separated by a center distance (m). The rotary stage 15 is rotated in the direction where the magnitude of the shadow by the scanning projection becomes minimum through an optical encoder 24 for detecting the rotating angle. The range-image data are composited by the structuring light, which is sequentially projected from the projecting point 32 at the arbitrarily specified angle. The range-image wherein the shadow part becomes minimum, is obtained by a triangulation method.

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[Claim(s)]

[Claim 1] Optical system which forms structuring light with a metering device which measures a three-dimension configuration of a strange body A projection device which carries out scan projection of said structuring light to ****** said end An image pick-up system which detects the reflected light from said body It is the projecting point migration mold range finder equipped with the above, and is characterized by enabling a setup of a projecting point of said structuring light in the predetermined angle range of arbitration which carried out fixed distance alienation from this medial axis on a plane right-angled to a medial axis of said image pick-up system.

[Claim 2] A projecting point migration mold range finder according to claim 1 characterized by supporting installation and this rotation base for said optical system and said projection device free [rotation] to the circumference of a medial axis of said image pick-up system in [a rotation base] one.

[Claim 3] A projecting point migration mold range finder according to claim 1 or 2 characterized by using as a sensing element of said reflected light of installation and said image pick-up system an optical encoder which has a slit on said rotation base detectable [an angle-of-rotation location of said projecting point].

[Claim 4] A projecting point migration mold range finder according to claim 1 or 2 which carries out the feature of having a control means which can form a rotary motor which carries out the rotation drive of this rotation base in a fixed case supported for said rotation base, enabling free rotation, and can control the angular position of said projecting point to a sensing element of said reflected light to arbitration.

[Claim 5] A projecting point migration mold range finder according to claim 1 or 2 characterized by supporting said whole image pick-up system in said fixed case free [rotation to the circumference of a medial axis of this image pick-up system].

[Claim 6] A projecting point migration mold range finder according to claim 1 or 2 characterized by having a control means which detects and controls the angular position used as field min of a shadow by said structuring light on which the angular position was changed into one by one, and it was projected by ****** at last from said two or more projecting points.

[Claim 7] A projecting point migration mold range finder according to claim 1 or 2 characterized by preparing the processing section which compounds depth map data obtained by carrying out sequential projection of said structuring light from said two or more projecting points, and generates a depth map of a shadow portion.

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] About a projecting point migration mold range finder (three-dimension shape-measurement equipment), more, it is constructed across by the point of an industrial robot or is fixed to the location of arbitration, and this invention is a metering device which performs the three-dimension shape measurement of ****** at last, and can be used for details suitable for a three-dimension configuration input unit (three-dimension digitizer) etc.

[0002]

[Description of the Prior Art] The recognizing ability which recognizes a three-dimension configuration for intelligent robots, such as an industrial robot, and a ultimate working robot or a monitor robot, is indispensable, and the quality of the recognizing ability of a three-dimension configuration influences these intelligent robots' engine performance. It has been a base to use the depth map obtained by measuring the three-dimension location on a body side as a recognition means of a three-dimension configuration, and there is ****** chronometric method, such as asking as a measurement means of a depth map from time amount until it receives the reflected light from the discharge time of a laser beam pulse, or the phase contrast between the incident light of a modulation laser beam and the reflected light. However, although ****** chronometric method has the feature that measurement precision is fixed, since it has the trouble that equipment is complicated and measurement time amount is long, in the present condition, many methods based on triangulation between incident light and an observation image are used.

[0003] The triangulation method machine **** method carries out scanning (scan) projection of the slit light (structuring light) to a body, observes incident light from a different angle, and asks for a depth map by the triangulation method from the location of a slit image. thus, if it consider as the conventional technology about the structure of the three dimension configuration measuring device which carry out scanning projection of the structuring light at last at ******, and measure the three dimension configuration of ****** at last, "the depth map input by space coding" (the IECE paper magazine 1985/3.VS.J68-DNO3), "the measurement time amount of a solid configuration measuring device" (Nikkei mechanical: 1994.12.26), and the "three dimensions information extract method" indicated by JP,06-117835,A propose

[0004] The above "the image input by space coding" makes the pattern light which floodlighted a pinstriped binary pattern light binary-code[for ******]-ized by ****** at last from the pattern light profile projector, and divided object space in the shape of [thin] a wedge, photos distance d for this with a ****** CCD (charge cvapled Device) camera from a pattern light profile projector, makes min the error of coding on the light-and-darkness section boundary of pattern light, and obtains a depth map by the triangulation method.

[0005] on the other hand, it be the method of "the measurement time amount of a solid configuration measuring device" irradiate a body, make into structuring light light by which outgoing radiation be carried out from the light source by a cylindrical lens etc., and scan it by a KARUBANO mirror etc., image-ize the reflected light by photo detectors, such as CCD, and detect an objective range direction by the triangulation method, and the physical relationship of the photo detector CCD of the picture input device to the outgoing radiation location of light be immobilization like the case of the above-mentioned "image input by space coding."

[0006] Moreover, "three-dimensions information extraction method is the method of taking a photograph with a television camera from the angle from which the symmetry section differs, processing two or more images, putting a symmetry object on a rotary table and rotating, describing the focus from each image, and describing the voxel of the three dimensions assumed to the three-dimensions space where the object which calculates the straight line of epilogue three-dimensions space for the projection center of each focus and its image, and represents the focus exists.

[0007]

[Problem(s) to be Solved by the Invention] The following technical problem occurs in the conventional range finder mentioned above.

[0008] if the shadow portion by which structuring light be irradiate arise and the focus to extract , a feature line , etc. be in the shadow portion when a certain body measure since the projecting point of structuring light and the location of CCD which detect the reflected light be immobilization , in the range finder of the 1st technical problem conventional technology , neither the focus which make into the purpose , nor a feature line extract .

[0009] Two or more optical system which forms structuring light when making the work launch complex of the 2nd technical-problem structuring light into plurality is established, or the light source is set to one, it is necessary to divide and use the light by which outgoing radiation was carried out, and optical system becomes large as a result, a range finder is enlarged and weight also serves as size from the light source.

[0010] In the 3rd technical-problem conventional technology, although the location of a projecting point and CCD is fixed and the adjustment for making it in agreement with the direction of structuring light (lengthwise direction) and the direction of an image of CCD (X, the direction of Y either) is needed, for an immobilization system, the adjustment is difficult and it takes assembly time amount.

[0011] Although the attaching position of the 4th technical problem CCD turns into 90 degrees, 180 degrees, and 270-degree arrangement in the same plane two cases as arrangement which loses a shadow portion when it makes structuring light plurality by immobilization for example, only the part of the number of outgoing radiation light needs assembly time amount, and requires assembly time amount like the 3rd technical problem of the above.

[0012] The pixel array of the 5th technical problem CCD is immobilization (for example, a pixel array is X:512 and Y:256), therefore the resolution according to direction is also immobilization. Therefore, if the attaching position of CCD is immobilization, height will be produced in the detection power to two or more structuring light, uniform measuring power will not be obtained but a precision fall will be produced.

[0013] In the case of the 6th technical-problem conventional technology, the field of a shadow portion changes with the locations of the body within a measurement visual field. (A shadow is so small that it is close to a projecting point within a visual field) . Therefore, in order to acquire the data of the field of a shadow portion, it will be necessary to move the whole equipment or to move the body itself, the migration device is needed, and equipment cost starts.

[0014] In order to obtain the depth map of a shadow portion in the case of the 7th technical-problem conventional technology, the whole equipment is moved, the image data of two or more sheets is incorporated, the processing for obtaining the distance data of a shadow portion is needed, the processing time becomes long, and it takes the time amount which measurement takes.

[0015] the distance data which this invention was made in view of the actual condition mentioned above, and does not have a shadow portion -- high degree of accuracy -- reliability -- it is high, and moreover, it is measurable for a short time and aims at making easy many adjustments of direction-of-radiation adjustment of the structuring light to the direction of a pixel of CCD etc., and offering a cheap and small range finder further.

[0016]

[Means for Solving the Problem] Optical system which invention of claim 1 is the metering device which measures a three-dimension configuration of a strange body, and forms structuring light, In a range finder which has an image pick-up system which detects a projection device which carries out scan projection of said structuring light to ****** said end, and the reflected light from said body it be characterize by make a setup possible , it have it in the predetermined angle range of arbitration which carried out fixed distance alienation of the project point of said structuring light from this medial axis on a plane right-angled to a medial axis of said image pick-up system , distance data without a shadow portion be obtain , measurement reliability be raise , and it be make to raise precision .

[0017] In a projecting point migration mold range finder according to claim 1, invention of claim 2 tends to be characterized by supporting installation and this rotation base for said optical system and said projection device free [rotation] in one on a rotation base at the circumference of a medial axis of said image pick-up system, tends to have it, tends to make it possible to abolish optical system required for two or more point projection, and tends to miniaturize equipment.

[0018] in a project point migration mold range finder according to claim 1 or 2 , invention of claim 3 can be characterize by use as a sensing element of said reflected light of installation and said image pick-up system an optical encoder which have a slit detectable [an angle of rotation location of said project point] , can have it in said rotation base , can double easily the direction of a pixel of CCD of the direction of structuring light , and shorten assembly time amount .

[0019] Invention of claim 4 is set to a projecting point migration mold range finder according to claim 1 or 2. A rotary motor which carries out the rotation drive of this rotation base is formed in a fixed case supported for said rotation base, enabling free rotation. It is characterized by having a control means which can control the angular position of said projecting point to a sensing element of said reflected light to arbitration, it has it, an angular relation-ship of a projecting point in two or more locations and CCD can be adjusted easily, and assembly time amount is shortened.

[0020] invention of claim 5 supported said whole image pick-up system in said fixed case free [rotation] at the circumference of a medial axis of this image pick-up system in a projecting point migration mold range finder according to claim 1 or 2 -- the feature -- carrying out -- having -- a fixed position of CCD -- free -- it can choose -- a direction which needs precision -- receiving -- equipment -- resolution is make high and precision is raise .

[0021] it be characterize by have a control means which detect and control the angular position used as field min of a shadow by said structuring light on which invention changed the angular position into claim 6 one by one from two or more of said project points in a project point migration mold range finder according to claim 1 or 2 , and it be projected by ****** at last , it have it , and an external body migration device be need , but it enable it to offer equipment at a low price .

[0022] invention of claim 7 be characterize by prepare the processing section which compound depth map data obtained in a project point migration mold range finder according to claim 1 or 2 by carry out sequential projection of said structuring light from said two or more project points , and generate a depth map of a shadow portion , have it , and it enable it to shorten time amount which measurement take .

[0023]

[Embodiment of the Invention] Drawing 1 is drawing for explaining an example of the handling system of the robot which has a projecting point migration mold range finder by this invention, among drawing, a hand and 3 place a projecting point migration mold range finder and 2 (it is henceforth described as a range finder.), one places a work and 5 for a robot and 4, and, as for an image processing system and 7, a base and 6 are [a robot controller and 8] host computers.

[0024] The range finder 1 is constructed across by a robot's 3 point, and a robot's handling system shown in drawing 1 is constituted so that the work 4 which placed and was put on the base 5 with the irregular posture by the hand 2 attached in a robot's 3 point based on the image information obtained from this range finder 1 may be handled. The image-processing information acquired from the range finder 1 is sent to a host computer 8 through an image processing system 6, and the posture of a work 4 is calculated, and the grasping location of a work 4 is computed. These calculation results are sent to the robot controller 7, and the robot controller 7 drives a robot 3 and a hand 2, and grasps a work 4.

[0025] Drawing 2 is drawing for explaining an example of the operation gestalt of the projection migration mold range finder by this invention. A plan and drawing 2 (B) drawing 2 (A) The view B-B line cross section of drawing 2 (A), The perspective diagram in which drawing 2 (C) shows the perspective diagram of the optical encoder 24, and drawing 2 (D) shows the shadow section of a work 4, Drawing 2 (E) is the plan showing the relation between CCD10 and structuring light. The inside of drawing, The image pick-up holder with which the lens of an image pick-up system and 10 contain CCD of an image pick-up system, and, as for 11, 9 contains a lens 9 and CCD10, 12, the follower gear by which a fixed case and 15 were attached in the rotation base, and 16 was attached [14] in the rotation base 15 for bearing and 13, 17 is 18 and the drive gear of the rotation base 15 and 22 are a laser diode (henceforth). The cylindrical lens of optical system and 20 19 described as LD The KARUBANO mirror of a light-scanning device, 21 a photo detector and 24 for the support arm of a photo detector 23, and 23 An optical encoder, the rotary motor with which 25 drives the rotation base 15, and 26 -- for structuring light (slit light) and 29, as for optical system and 31, the medial axis of an image pick-up system and 30 are [the drive motor of the KARUBANO mirror 20, and 27 / the fixed screw of the image pick-up holder 11, and 28 / a light-scanning device (it is henceforth described as a scanning device) and 32] projecting points.

[0026] The range finder 1 shown in drawing 2 makes the optical axis of an image pick-up system which consists of a lens 9 and CCD10 a medial axis 29, and consists of the optical system 30 and the light-scanning devices 31 which were attached in the image pick-up holder 11 which contained this image pick-up system, the fixed case 13 which supports this image pick-up holder 11 on the same axle, the rotation base 15 which is supported by this fixed case 13 and rotates on a medial axis 29 and the same axle, and the rotation base 15.

[0027] A rotation location is adjusted through bearing 12 in the tubed fixed case 13, and the image pick-up holder 11 which contained the image pick-up system is being fixed to the fixed case 13 by the same axle. Namely, the fixed screw 27 is formed in the image pick-up holder 11, and this fixed screw 27 is rotated and it can fix now to the fixed case 13. Moreover, the same axle bearing 14 is formed in the outside of the tubed fixed case 13, and the rotation base 15 is supported by the fixed case 13 free [rotation] through bearing 14.

[0028] Optical system 30 and the scanning device 31 are being fixed to the rotation base 15 so that the optical axis may turn into the medial axis 29 of an image pick-up system with field parallel on a right-angled field. Optical system 30 consists of LD18 and a cylindrical lens 19, the scanning device 31 has the KARUBANO mirror 20 by which a rotation drive is carried out with a drive motor 26, and the fixed distance m is maintained between the projecting point 32 of this gal BANOMORA 20, and the image pick-up system medial axis 29. Moreover, the follower gear 16 and the optical encoder 24 fix on a medial axis 29 and the same axle, the rotary motor 25 which fixed centering on the drive gear 17 is attached in the rotation base 15 at the fixed case 13, and this drive gear 17 and the follower gear 16 which fixed on the rotation base 15 are arranged in the engagement position.

[0029] As shown in drawing 2 (C), it is in a circle, and slit 24a of constant width is prepared in the radiation direction at equal intervals from a center, and the optical encoder 24 is set up between LD22 attached in the fixed case 13, and this LD22 and the photo detector 23 which fixed on the support arm 21 in the location which countered. On the other hand, beam plastic surgery is carried out by the cylindrical lens 19 at the structuring light (slit light) 38, and it is reflected at the projecting point 32 of the KARUBANO mirror 20, and is projected on the laser beam by which outgoing radiation was carried out from LD18 of optical system 30 by the space lower part sense of drawing 2 .

[0030] If a control signal is impressed to a rotary motor 25 and it is made to rotate the rotation base 15 on the same axle to the fixed case 13 under the above configuration, a setup to the arbitration angular position will be attained in the projecting point 32, maintaining the fixed distance m to CCD10. Moreover, the fixed screw 27 formed in the image pick-up holder 11 is loosened, and modification becomes possible free about the rotation location of CCD10 by rotating the image pick-up holder 11 to the fixed case 13. When the location of a work 4 is located in the location shown in drawing 2 (D) and structuring light is projected by the above configuration, even if a shadow portion arises, if 180 degrees of rotation bases 15 are rotated, level difference partial 4a of a work 4 which becomes a shadow and hides will also become measurable, for example. Furthermore, it becomes possible easily by rotating the image pick-up holder 11 and being able to change the angle of the projecting point 32 over CCD10 to adjust so that the structuring light 28 to CCD10 may be in agreement with the direction of arrow head Y, as shown in drawing 2 (E). Next, a position control means is described whenever [projection point-angle].

[0031] Drawing 3 is a block diagram for explaining the operation gestalt of a control means whenever [concerning the projecting point migration mold range finder of this invention / projection point-angle], and, as for a position control means and 34, 33 are [an impulse counter and 35] Motor Driver whenever [projection point-angle] among drawing.

[0032] Whenever [projection point-angle / which was shown in drawing 3], the position control means 33 consists of an impulse counter 34 and Motor Driver 35, and it connects with Motor Driver 35 and it drives a rotary motor 25. For example, when a pulse motor is used as a rotary motor 25, aim pulse number 34b is beforehand set to the impulse counter 34 of the position control means 33 whenever [projection point-angle], and encoder signal 34a is inputted from the optical encoder 24. Aim pulse number 34b is set to the pulse number from which a location becomes 90 degrees, 180 degrees, and 270 degrees for example, whenever [projection point-angle], and when angle of rotation corresponding to the pulse number set by comparing the signal pulse number of encoder signal 34a from this and an encoder 24 is reached, a stop signal can be sent out to a rotary motor 25. Here, since the whole image pick-up system can be freely rotated to a medial axis 29, although it is manual even when the numbers of pixels of X and the direction of Y which CCD10 has differ, the selection of resolution of it is attained. here -- a direction -- it is good to always make resolution the optimal to enable rotation of the image pick-up holder 11 by a motor etc. to the fixed case 13.

[0033] Next, the shadow partial distance data generation processing section is explained to be a shadow field minimization means based on drawing 4 and drawing 5 .

[0034] with [for drawing 4 to explain the operation gestalt of the shadow field minimization means of the projecting point migration mold range finder by this invention] a block -- it is -- the inside of drawing, and 36 -- for Motor Driver and 39, as for a laser diode (LD) driver and 41, a switching circuit and 40 are [a shadow field minimization means and 37 / a D/A converter and 38 / quiescence memory and 42] microcomputers.

[0035] In drawing 4 , the shadow field minimization means 36 consists of the quiescence memory 41 and the microcomputers 42 which remember the luminance signal to be a control means 33 and CCD10 whenever [angle-of-projection / which was indicated to be the light-scanning device driving means which drives the galvanomirror 20 of the light-scanning device 31, and the optical-system driving means which drives LD18 of optical system 30 to drawing 3]. In the above configuration, the light-scanning device driving means of a galvanomirror 20 consists of D/A converter 37 which makes the control signal of a drive motor 26, Motor Driver 38, and this Motor Driver 38. LD18 optical-system driving means consists of the switching circuit 39 and the LD driver 40 which carry out ON/OFF of the power supply of LD18. Next, actuation of a shadow field minimization means 36 by which it **4**(ed) is explained according to drawing 5 .

[0036] Drawing 5 is drawing for explaining actuation of the shadow field minimization means shown in drawing 4 . If the laser beam by which placed and outgoing radiation was carried out from LD18 to the work 4 on a base 5 (detection body) is irradiated through a galvanomirror 20 as shown in drawing 5 (A), shadow 5a will arise. For example, as an easy rectangular-head board, the rectangular-head side is made into X and the direction of Y, height is made into a Z direction for the form of a work 4, and CCD10 detects the brightness of the work 4 of X shaft orientations. Although the brightness in not glaring [which does not carry out outgoing radiation of the laser beam] turns into brightness of the level shown by the dotted line LB0 of drawing 5 (B) from LD18, when outgoing radiation of the laser beam is carried out, the shadow 5a portion which is shown in drawing 5 (C) and which is the brightness of a low like LC1 arises. A microcomputer 42 compares LB1 (continuous line) which added slight fixed offset, and the brightness LC 1 shown in drawing 5 (C) to the non-glared brightness LB0. As this result is shown in drawing 5 (D), in the sections X1-X2, the non-glared brightness LB1 becomes larger than the brightness LC 1 of all exposures, and ** that it is shadow 5a. A control means 33 is driven for this actuation whenever [angle-of-projection], a certain defined angle, for example, 0 degree, 90 degrees, 180 degrees, and 270 degrees are rotated, sequential migration of the projecting point 32 is carried out, and the angular position of the projecting point 32 that a shadow field serves as min is detected.

[0037] Drawing 6 is drawing for explaining the operation gestalt of the distance data generation processing section of the shadow portion of the projecting point portable type range finder by this invention. It is the perspective diagram showing the condition that drawing 6 (B) changed whenever [illuminating-angle / of structuring light] to the work in drawing 6 (A) to the block diagram of the distance data generation processing section of a shadow portion, and, for 43, as for a binary-ized circuit and 45, the distance data generation processing section of a shadow portion and 44 are [space code memory and 46] memory among drawing.

[0038] The distance data generation processing section 43 of the shadow portion shown in drawing 6 finds the height on the Z-axis of the work of the portion which produces a shadow based on the principle of the space coding method, and the distance data generation processing section 43 of a shadow portion consists of the binary-ized circuit 44, the space code memory 45, the quiescence memory 41, a microcomputer 42, and memory 46. It connects with a serial, and the contact of one side of the two-way-type change-over switches SW1 and SW2 is switched between CCD10 and the quiescence memory 41, it connects, and the binary-ized circuit 44 and the space code memory 45 make the image input signal of CCD10 binary in the binary-ized circuit 44, carry out binary encoding of this by the space code memory 45, and are inputted into the quiescence memory 41. Binary-ized error generating which direct continuation is carried out, and the raw image by which binary encoding is not carried out is inputted into the quiescence memory 41, and is produced by brightness change of a raw image is removed between the contacts of the other side of switches SW1 and SW2.

[0039] The space coding method is one solid instrumentation system which asks for a depth map by the triangulation method from the picture signal which continued and projected the structuring light by the laser beam on measuring range from the projecting point 32 which is in a ****** location about the distance m of the direction of an axial right angle from the medial axis 29 of an image pick-up system, and detected this reflected light by CCD10. First, the field of the one half of measuring range is not illuminated with the power supply OFF of structuring light, but light scanning of the field of the next one half is specifically carried out with a power supply ON. Next Henceforth, one by one, ON of a power supply and the field gap of OFF are reduced by half, the power supply of structuring light is made to turn on and turn off every 1/4 field of measuring range, it scans, and the condition of the power supply [input signal / image] OFF is coded with a binary number, using the condition of "0" and ON as "1." An image with binary code with the digit of the count scanned by the binary code for said every scan is set to a measuring plane. When a plane has a measuring plane, a code is located in a line in good order, but if there is a high portion by the solid, a shadow will arise and said binary code array will change. Since it depends for this array on height, height can be found by the same method as triangulation.

[0040] In this invention, as shown in drawing 6 (B), the shadow detection location of a work 4 and the location of an edge are memorized to the work 4 from the illuminance data which projected the structuring light shown as a continuous line, and was first obtained from the projecting point 32 of a galvanomirror 20. Next, for example, by the distance data which projected the structuring light shown by the dotted line in the projecting point 32 (not shown) of a location to a location of the first projecting point 32 shown as a continuous line different 180 degrees, since a shadow starting position **** in the location of an edge, the location data at this time is incorporated and a postscript is added to the first distance data. Here, ** which sets a shadow portion to 0 (zero) by the first distance data is desirable. Furthermore, since illuminance data is obtained by the angular position which makes a shadow portion min, the depth map of the 2nd sheet in the space coding method does not need to incorporate all, and can aim at compaction of the measuring time.

[0041]

[Effect of the Invention]

The effect corresponding to claim 1 : with the metering device which measures the three-dimension configuration of a strange body In the range finder which has the image pick-up system which detects the optical system which forms structuring light, the projection device which carries out scan projection of said structuring light to ****** said end, and the reflected light from said body Since a setup of the projecting point of said structuring light in the predetermined angle range of the arbitration which carried out fixed distance alienation from this medial axis on a plane right-angled to the medial axis of said image pick-up system was enabled, distance data without a shadow portion is obtained and improvement in the reliability of measurement and precision can be aimed at.

[0042] effect: corresponding to claim 2 -- in a projecting point migration mold range finder according to claim 1, rotation of installation and this rotation base is enabled for said optical system and said projection device in one on a rotation base at the circumference of the medial axis of said image pick-up system, there is no optical system required for two or more point projection, and equipment can be miniaturized.

[0043] effect: corresponding to claim 3 -- since the optical encoder which have a slit on said rotation base use as the sensing element of said reflected light of installation and said image pick-up system detectable [the angle of rotation location of said project point], the direction of structuring light and the pixel array direction of CCD make suit easily, and compaction of assembly time amount aim at in a project point migration mold range finder according to claim 1

[0044] The effect corresponding to claim 4 : In a projecting point migration mold range finder according to claim 1 or 2 Since the rotary motor which carries out the rotation drive of this rotation base was formed in the fixed case supported for said rotation base, enabling free rotation and the control means which can control the angular position of said projecting point to the sensing element of said reflected light to arbitration was established the angular relation-ship of the projecting point in two or more locations, and CCD -- easy -- it can adjust -- the above (3) -- compaction of assembly time amount can be aimed at similarly.

[0045] effect: corresponding to claim 5 -- since this whole image pick-up system was supported in said fixed case free [rotation] at the circumference of an image pick-up system medial axis in the project point migration mold lens finder according to claim 1 or 2 -- the fixed position of CCD -- free -- it can choose -- the direction which needs precision -- receive -- equipment -- resolution can be make high and improvement in precision can aim at.

[0046] effect: corresponding to claim 6 -- in a project point migration mold range finder according to claim 1 or 2, the control means which detect and control the angular position used as the field min of the shadow by said structuring light on which the angular position be changed into one by one, and it be projected by ****** at last from two or more of said project points be establish, and an external body migration device be need, but equipment cost can be make cheap.

[0047] effect: corresponding to claim 7 -- in a projecting point migration mold range finder according to claim 1 or 2, since the processing section which compound the depth map data obtained by carrying out sequential projection of said structuring light from said two or more projecting points, and generate the depth map of a shadow portion be prepared, the time amount which measurement take can be shorten

[Brief Description of the Drawings]

[Drawing 1] It is the handling system of the robot which has projecting point migration mold range FAINDE by this invention.

[Drawing 2] It is drawing for explaining an example of the operation gestalt of the projection migration mold range finder by this invention.

[Drawing 3] It is a block diagram for explaining the operation gestalt of a control means whenever [concerning the projecting point migration mold range finder of this invention / projection point-angle].

[Drawing 4] It is a block diagram for explaining the operation gestalt of the shadow field minimization means of the projecting point migration mold range finder by this invention.

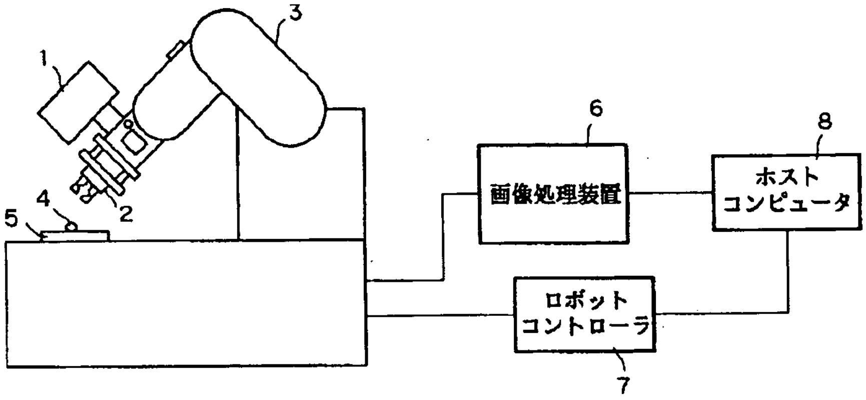
[Drawing 5] It is drawing for explaining actuation of the shadow field minimization means of the block diagram shown in drawing 4 .

[Drawing 6] It is drawing for explaining the distance data generation processing section operation gestalt of the shadow portion of the projecting point portable type range finder by this invention.

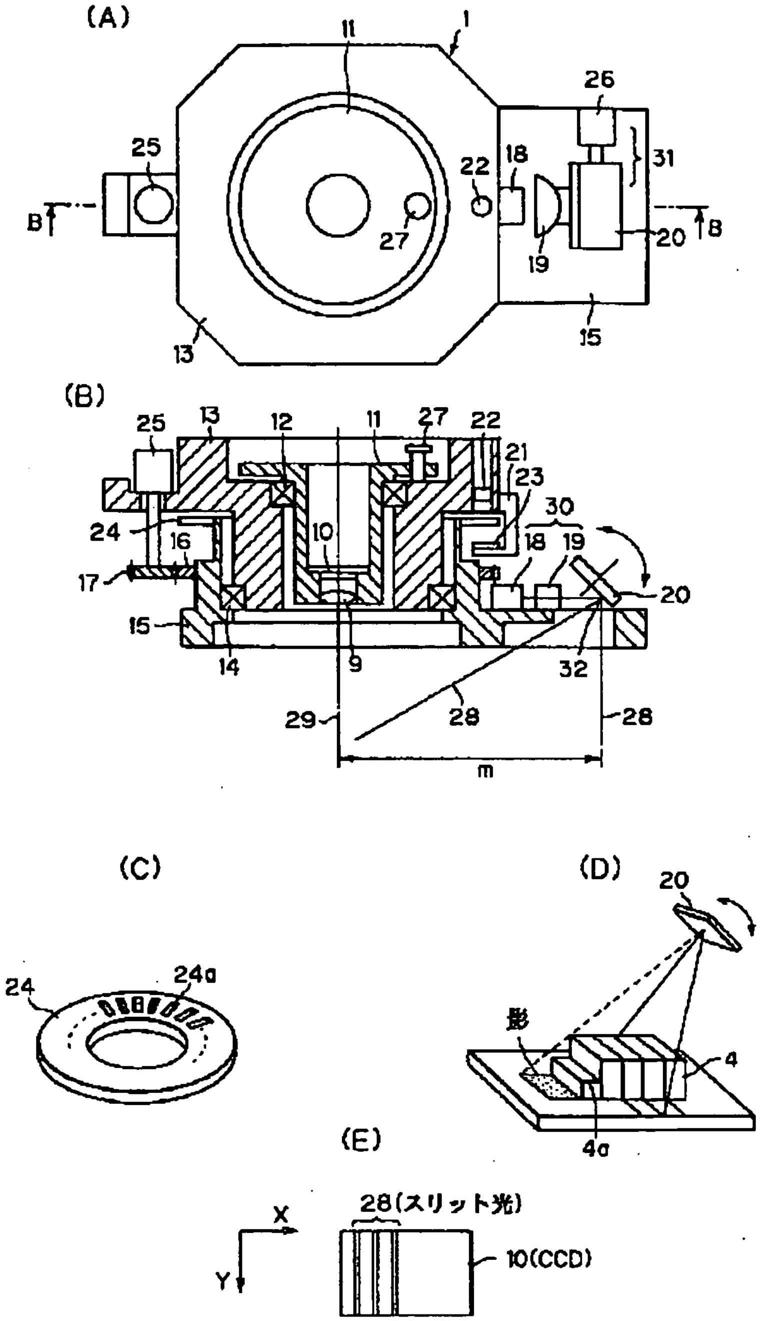
[Description of Notations]

1 [-- A work, a 5 -- every base,] -- A range finder, 2 -- A hand, 3 -- A robot, 4 6 -- An image processing system, 7 -- A robot controller, 8 -- Host computer, 9 [-- Bearing,] -- A lens, 10 -- CCD, 11 -- 12 An image pick-up holder, 14 13 [-- Drive gear,] -- A fixed case, 15 -- A rotation base, 16 -- A follower gear, 17 18 -- A laser diode (LD), 19 -- A cylindrical lens, 20 -- KARUBANO mirror, 21 [-- An optical encoder,] -- A support arm, 22 -- A laser diode, 23 -- A photo detector, 24 25 [-- Structuring light,] -- A rotary motor, 26 -- A drive motor, 27 -- A fixed screw, 28 29 -- The medial axis of an image pick-up system, 30 -- Optical system, 31 -- Scanner (scanning device), 32 -- A projecting point, 33 -- It is a position control means and 34 whenever [projection point-angle]. -- Impulse counter, 35 38 [-- A switching circuit, 40 / -- LD driver, 41 / -- Quiescence memory, 42 / -- A microcomputer, 43 / -- The distance data generation processing section 44 / -- A binary-ized circuit, 45 / -- Space code memory, 46 / -- Memory.] -- Motor Driver, 36 -- A **** minimization means, 37 -- A D/A converter, 39

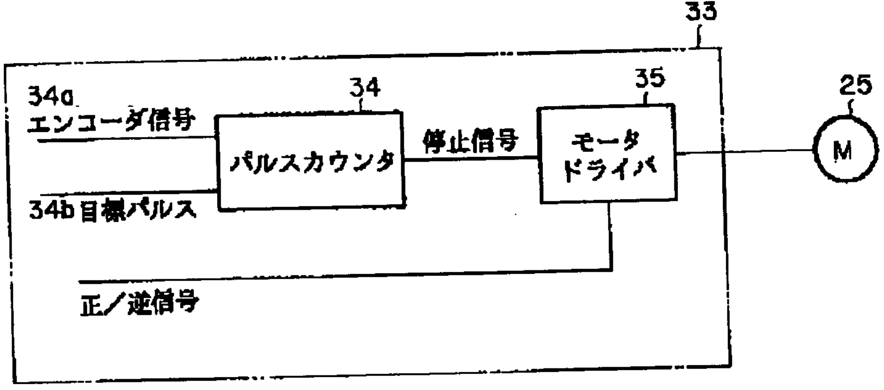
[Drawing 1]


1
2
3
4
5
6
画像処理装置
8
ホスト
コンピュータ
ロボット
コントローラ
7

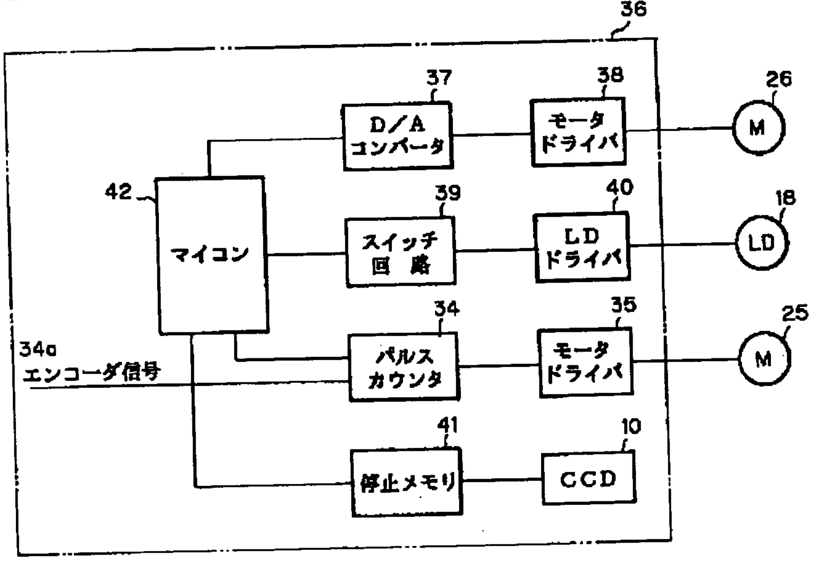
[Drawing 2]


(A)
B
B
(B)
m
(C)
(D)
影
4a
(E)
X
28(スリット光)
10(CCD)
Y

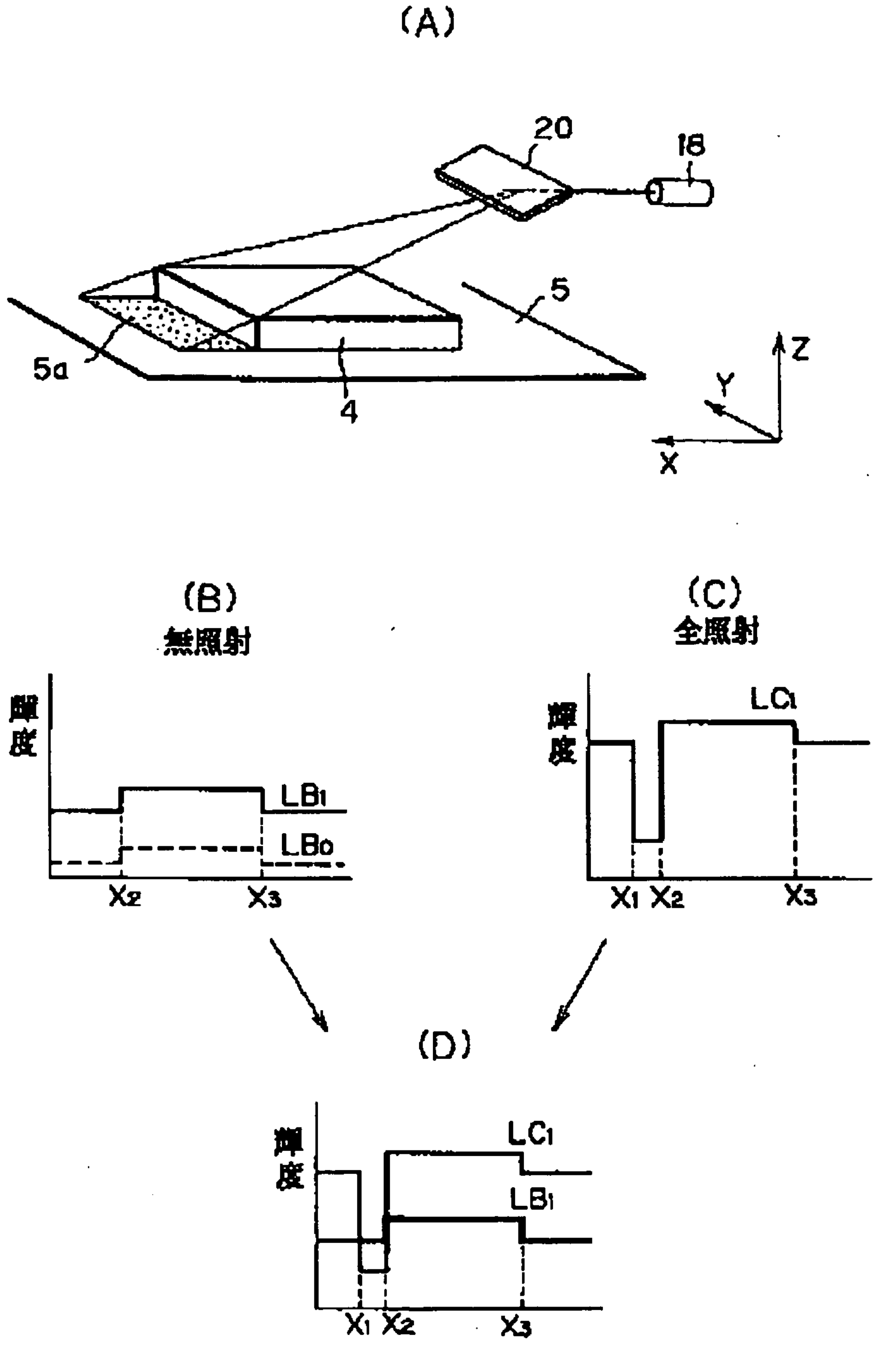
[Drawing 3]


33
34a
エンコーダ信号
34
パルスカウンタ
停止信号
35
モータ
ドライバ
25
M
34b 目標パルス
正／逆信号

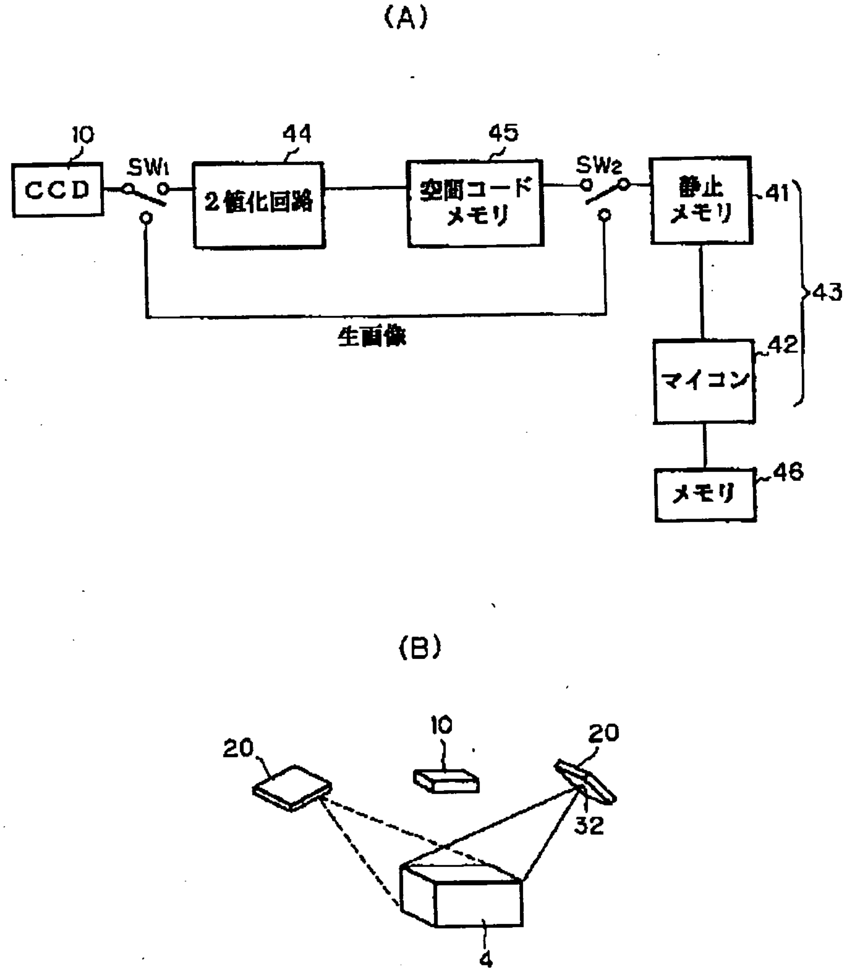
[Drawing 4]


36
37
D／A
コンバータ
38
モータ
ドライバ
26
M
42
マイコン
39
スイッチ
回路
40
LD
ドライバ
18
LD
34
パルス
カウンタ
35
モータ
ドライバ
25
M
34a
エンコーダ信号
41
停止メモリ
10
CCD

[Drawing 5]


(A)
20
18
5
5a
4
Z
Y
X
(B)
無照射
輝度
LB1
LB0
X2
X3
(C)
全照射
輝度
LC1
X1
X2
X3
(D)
輝度
LC1
LB1
X1
X2
X3

[Drawing 6]


(A)
10
CCD
SW1
44
2値化回路
45
空間コード
メモリ
SW2
静止
メモリ
41
43
生画像
マイコン
42
メモリ
46
(B)
20
10
20
32
4